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Transportation

Improved Railroad Grade Crossings

June 1982

An Urban Consortium Information Bulletin

Urban
Consortium
for Technology Initiatives

Urban Consortium for Technology Initiatives

Member Jurisdictions

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The Urban Consortium for Technology Initiatives was formed to pursue technological solutions to pressing urban problems. The Urban Consortium is a coalition of 37 major urban governments, 28 cities and 9 counties, with populations over 500,000. These 37 governments represent over 20% of the nation's population and have a combined purchasing power of over $25 billion.

Formed in 1974, the Urban Consortium represents a unified local government market for new technologies. The Consortium is organized to encourage public and private investment to develop new products or systems which will improve delivery of local public services and provide cost-effective solutions to urban problems. The Consortium also serves as a clearinghouse in the coordination and application of existing technology and information.

To achieve its goal, the Urban Consortium identifies the common needs of its members, establishes priorities, stimulates investment from Federal, private and other sources and then provides on-site technical assistance to assure that solutions will be applied. The work of the Consortium is focused through 10 task forces: Community and Economic Development; Criminal Justice; Environmental Services; Energy; Fire Safety and Disaster Preparedness; Health; Human Resources; Management, Finance and Personnel; Public Works and Public Utilities; and Transportation.

Public Technology, Inc. is the applied science and technology organization of the National League of Cities and the International City Management Association. It is a nonprofit, tax-exempt, public interest organization established in December 1971 by local governments and their public interest groups. Its purpose is to help local governments improve services and cut costs through practical use of applied science and technology. PTI sponsors the nation's local government cooperative research development, and technology transfer program.

PTI's Board of Directors consists of the executive directors of the International City Management Association and the National League of Cities, plus managers and elected officials from across the United States.

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Prepared by
PUBLIC TECHNOLOGY, INC.
1301 Pennsylvania Avenue, NW
Washington, D.C. 20004

Secretariat to the
URBAN CONSORTIUM FOR TECHNOLOGY INITIATIVES

Supported by
U.S. Department of Transportation
Washington, D.C. 20590

DOT-I-82-54

PREFACE

This is one of ten bulletins in the fifth series of Information Bulletins produced by the Transportation Task Force of the Urban Consortium for Technology Initiatives. Each bulletin in this series addresses a priority transportation need identified by member jurisdictions of the Urban Consortium. The bulletins are prepared for the Transportation Task Force by the staff of Public Technology, Inc. and its consultants.

Ten newly identified transportation needs are covered in this fifth series of Information Bulletins. In priority order they are:

- Growth Management and Transportation
- Intercepting Downtown-Bound Traffic
- Inflation Responsive Transit Financing
- Impact of Traffic on Residential Areas
- Coordination of Parking with Public Transportation and Ridesharing
- Improved Railroad Grade Crossings
- Flexible Federal Design Standards for Highway Improvements
- Traffic Signal Maintenance
- Inflation Responsive Financing for Streets and Highways
- Flexible Parking Requirements

The needs highlighted by Information Bulletins are selected in an annual process of needs identification used by the Urban Consortium. By focusing on the priority needs of member jurisdictions, the Consortium assures that resultant research and development efforts are responsive to local government problems.

Each bulletin provides a nontechnical overview, from the local government perspective, of issues and problems associated with each need. Current research efforts and approaches to the problem are identified. The bulletins are not an in-depth review of the state-of-the-art or the state-of-the-practice. Rather, they serve to identify and raise issues and as an information base from which the Transportation Task Force selects topics that require a more substantial research effort.

The Information Bulletins are also useful to those, such as elected officials, for whom transportation is but one of many areas of concern.

The needs selection process used by the Urban Consortium is effective. Priority needs selections have been addressed by subsequent Transportation Task Force projects:

- To facilitate the provision of transportation services for elderly and handicapped people, five products have been developed: Elderly and Handicapped Transportation: Chief Executive's Summary, Elderly and Handicapped Transportation: Planning Checklist, Elderly and Handicapped Transportation: Information Sourcebook, Elderly and Handicapped Transportation: Eight Case Studies.

- To help improve center city circulation (with the objectives of downtown revitalization and economic development) several projects have been completed. A summary report on Center City Environment and Transportation: Local Government Solutions shows how 7 cities use transportation and pedestrian improvements as tools in downtown revitalization. A report titled Center City Environment and Transportation: Transportation Innovations in Five European Cities discusses exemplary approaches to resolving traffic management problems common to cities with large numbers of automobiles. Another project, addressing the coordination of public transportation investment with real estate development, has culminated in two major national conferences--the Joint Development Marketplaces I and II. The second Marketplace, held in Washington, DC, in July 1980, was attended by a total of over 500 people, including exhibitors from 32 cities and counties and representatives of private development and financial organizations.

- A series of documents relating to the need for Transportation Planning and Impact Forecasting Tools has been prepared: (1) a management-level document for local officials describing manual and computer transportation planning tools available from the U.S. Department of Transportation, (2) a series of case studies of local government and transit agency applications of these tools, and (3) a guide describing ways local governments can gain access to these tools.

- To meet the need to promote the use of Transportation System Management (TSM) measures, a series of five regional meetings was held in 1980 to provide local, State, and Federal officials, and representatives of transit agencies and the business community with the opportunity to exchange information about low-cost TSM projects to improve existing transportation systems.

- To facilitate the dissemination of information on local experiences in Parking Management, a technical report describing the state-of-the-art has been prepared.

- To address the need for information on transit productivity, a seminar on International Transit Performance Measurement was held in September 1980. The seminar included presentations on the state-of-the-art in France, Germany, and the United States. The seminar was co-sponsored by the German Marshall Fund of the United States.

- To encourage improved design in transportation facilities, PTI organized Design for Moving People, the first national conference to bring together leading design professionals--architects, artists, arts administrators--and those responsible for operating and managing many of the nation's largest public mass transportation systems. The meeting was held in May 1981 in New York. Cosponsored by the American Public Transit Association (APTA), the New York Chapter of the American Institute of Architects, AMTRAK, and the Municipal Art Society of New York, the two day conference featured keynote addresses by two of the country's leading architects, case studies, and practical workshops on topics such as financing design excellence, promoting better collaboration between architects and artists, and materials selection--vandalism and maintenance.

- To address the issue of adequate financing for transit and the difficult policy decisions facing operating authorities regarding fare setting and the role fares should play in meeting financial needs, the Urban Mass Transportation Administration (UMTA) and the American Public Transit Association (APTA) sponsored a fare policy seminar, with the help of PTI, for general managers and board members in Region III. The seminar was held in Washington, D.C. in September 1981, at APTA's offices. Consulting experts presented the results of relevant research sponsored by UMTA's Office of Service and Methods Demonstrations.

- To test the effectiveness of the video teleconference as a means of communicating information to local officials quickly and efficiently and to address the need to find less costly alternatives to fixed route transit,PTI organized and staffed a successful teleconference under UMTA sponsorship in 1982. Entitled "Adjusting to Reduced Transportation Budgets: Operational Strategies," the teleconference provided local officials in five cities with information about alternative transportation services suitable for areas where conventional transit service is either impractical or unduly expensive.

Task Force information dissemination and technology sharing concerns are currently addressed by three products--SMD Briefs, Transit Actions and Transit Technology Briefs. SMD Briefs are short reports that provide up-to-date information about specific aspects of on-going projects of UMTA's Office of Service and Methods Demonstrations (SMD). In addition, the SMD HOST Program allows transportation officials from selected jurisdictions to visit one of these projects for on-site training. Transit

Actions cover the on-going projects of UMTA's Office of Transportation Management. Each Action provides timely information that will be especially useful to transit managers concerned with improving their transit systems' efficiency and effectiveness. Transit Technology Briefs report on projects sponsored by UMTA's Office of Technology Development and Deployment. These timely documents provide information that should be of direct benefit in the improvement and productivity of transit system operations.

Additional Technology Sharing occurs through the National Cooperative Transit Research Program (NCTRP) which was organized jointly by Public Technology, Inc., the American Public Transit Association, the Urban Mass Transportation Administration, and the Transportation Research Board to address problems relating to public transportation identified by local and State government and transit administrators.

The support of the U.S. Department of Transportation's Technology Sharing Division in the Office of the Secretary, Federal Highway Administration, National Highway Traffic Safety Administration, and Urban Mass Transportation Administration has been invaluable in the work of the Transportation Task Force of the Urban Consortium and the Public Technology, Inc. staff. The guidance offered by the Task Force members will continue to ensure that the work of the staff will meet the urgent needs identified by members of the Urban Consortium for Technology Initiatives.

The members of the Transportation Task Force are:

- George Simpson (Chairperson)
  Assistant Director
  Department of Engineering and Development
  City of San Diego
  San Diego, California

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  Director of Transportation
  Montgomery County
  Rockville, Maryland

- Kent Dewell
  Deputy Director, Public Works Department/Transportation Division
  City of San Jose
  San Jose, California

- David Gurin
  Deputy Commissioner
  New York City Department of Transportation
  New York, New York

- Edward M. Hall (Vice Chairperson)
  Street Transportation Administrator
  City of Phoenix
  Phoenix, Arizona

- William K. Hellmann
  Chief, Interstate Division for Baltimore City
  Baltimore, Maryland

- Rod Kelly
  Director, Office of Transportation
  City of Dallas
  Dallas, Texas

- Frank Kiolbassa
  Director of Public Works
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  Department of City Planning
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  City of Seattle
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Project Sponsors

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  Chief, Transit Services Division, Office of Service and Management Demonstrations
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Chapter 1

INTRODUCTION

Railroad-highway grade crossings have been an area of concern to cities and counties for many years. While substantial progress has been made in resolving some aspects of the problem, much remains to be solved. Overlapping responsibility and misunderstandings between the different parties involved further complicate attempts at progress. That further study in this area is required was recognized by the Transportation Task Force of the Urban Consortium when it designated railroad-highway grade crossings as one of its top 10 transportation needs.

ISSUES AND PROBLEMS

Three major areas of concern were identified:

- Safety: Great efforts have been made in improving the safety of railroad grade crossings. These have resulted in a 2/3 reduction in fatalities directly attributable to a motor vehicle-train collision. However, many improvements can still be made.

- Physical Condition: There are thousands of rough, substandard railroad crossings presenting serious safety hazards and damaging vehicle tires and wheels, wheel alignment, shock absorbers, and steering mechanisms. Maintenance of the crossings is costly and difficult because of the repeated shock loads from rail traffic and truck traffic. Light vehicles, such as mopeds and bicycles, are put at hazard by poorly maintained rail crossings.

- Institutional Concerns: Many different organizations share responsibility for grade crossings. Officials are often frustrated in their attempts to improve the condition of a crossing because of overlapping responsibility or apparent indifference on the part of the railroad. This perceived indifference extends to day-to-day operations as well, when train scheduling interferes with normal mobility in the town. As coal unit train traffic increases, so does the magnitude of the interference. Unit trains frequently block intersections for 20 minutes or more, cutting off emergency access.

SAFETY

Accidents at railroad-highway grade crossings have been a major concern for many years. However, the cost of making substantial improvements hampered efforts until recent years. The issue has been further complicated by a lack of clarity regarding areas of responsibility. The railroads initially held virtually sole responsibility for grade crossings; however, States have assumed more of that burden, especially in the area of advance warning devices, as traffic has grown.

In some instances, the railroad which constructed and used a section of track is no longer in business, leaving the city with no clear path to pursue if a hazard exists.

Since the enactment of the Federal Highway Safety Act of 1973, many improvements have been made. Section 203 of this Act specifically authorizes the use of Highway Trust Fund money to upgrade hazardous railroad grade crossings. The States are responsible for identifying hazards and establishing project priorities. These funds are generally used to install or improve warning devices and markings, and when necessary to install a grade separation so that the road avoids the railroad tracks entirely. Grade separations are generally viewed as a last resort because of their high cost. The projects are administered by the States. Federal funds will pay up to 90% of the costs of the project. Other Federal-aid highway funds are available, such as primary and secondary funds, which may pay up to 100% of the costs. According to the Office of Highway Safety of the Federal Highway Administration (FHWA), the effect of this effort has been to reduce fatalities at highway-railroad grade crossings from about 1600 annually in the 1960s to fewer than 700 in 1981. This figure, although small compared to the overall annual number of traffic fatalities, may be reduced further with improvements in warning and traffic control devices, changes in driver perceptions, and reconstruction of the crossings themselves.

Grade Crossing Traffic Control Devices

There are several forms of grade crossing traffic control and warning devices: active, passive, and advance warnings.

- Active devices are gates, flashing lights, signals or bells which actively warn the motorist of the train's approach. Some actually block the path to automobile traffic. These devices are usually triggered by a train sensor located along the track leading to the intersection.

- Passive devices include signs, pavement markings, and other warnings which do not change state with the approach of a train.

- Advance warnings are devices placed some distance from the crossing which advise the motorist that he or she is nearing a grade crossing.

Different organizations have differing responsibilities for these types of warnings. The local highway authority usually assumes responsibility for advance warning signs. These warning signs have received less emphasis than active warning devices, and a program designed to upgrade and activate advance warnings might well show positive results.

Local traffic personnel may have to take into consideration the timing of traffic signals near the grade crossing. To avoid blocked intersections, it may be necessary to program nearby traffic signals to take account of a train. Many of the new computerized traffic signal systems can be programmed to receive commands from a train detector's system and to change phases as necessary when a train is passing through.

At-crossing active and passive warning systems and the train detection devices which trigger those warning systems fall under the jurisdiction of the railroad. This is appropriate, as the detection devices must be located along the tracks in order to detect the train. This overlap of responsibility can

complicate efforts to improve the warning system, as different groups have different perceptions of the degree of urgency involved.

While research is continually being conducted in efforts to improve the effectiveness of all forms of warning devices, cities and railroads are understandably reluctant to serve as guinea pigs for new development. The risk of being held liable for accidents occurring at test sites can drastically inhibit willingness to introduce new technology.

Driver Perceptions

Many accidents occur because the motorist, although warned, chooses to ignore the warning. Maintaining driver faith in the warning system is difficult.

When the grade crossing is equipped with active warning devices, the driver may believe that the warnings were triggered prematurely or that the warning is a false alarm. Premature warnings often occur when the detector system has been designed to activate the warnings once a train is within a certain distance of the grade crossing. The system is designed with the fastest expected train in mind, which means that a slower train will activate the warning devices (thereby blocking the crossing) much earlier than necessary. If this happens frequently, the warning signals lose credibility with motorists, especially those who traverse the crossing often. The driver decides that there is still time to cross before the train arrives, and depending on the accuracy of his judgement, may or may not succeed in crossing safely.

Sometimes signals go off when no train is actually approaching the intersection. This severely weakens the warning systems' credibility. Although actual malfunction of the dectector system is rare, signals are sometimes triggered when a train switching station is located near a grade crossing. The train may not come near the crossing for quite some time, as it picks up or drops off cars, but the warning system may be activated throughout. Motorists become convinced that no train is approaching, ignore the warning system, and cross the tracks.

The driver approaching an intersection equipped only by passive warning devices must rely entirely on his or her own senses. If visibility is limited, or if he or she is not capable of properly estimating an oncoming train's speed, potential for disaster is high. At rarely-used crossings, the driver may not even feel the need to check for an oncoming train. In the absence of advance warnings, the driver can come upon the grade crossing entirely unaware.

There is a need for good advance warnings so that drivers are notified that a grade crossing is coming up.

A survey of over 1250 drivers conducted by James Sanders, of BioTechnology, Inc, produced the following observations about driver behavior:

- Roughness, not safety, is the main reason why drivers slow down for grade crossings. Drivers also tend to underestimate their speed by up to 30 percent.

- Most drivers were aware of the grade crossing from past experience, not from the warning devices. Almost one percent of the drivers passed through the grade crossing without being aware that it was there.

- Over 40 percent of the drivers believed that the time between signal activation and train arrival was greater than a minute. Actually, the time elapsed varied between 18 and 82 seconds. Standards contained in the U.S. DOT Manual on Uniform Traffic Control Devices call for a minimum of 20 seconds of warning before the train reaches the crossing. Over half of the drivers said that their average delay was more than five minutes. Many drivers were not aware that visibility was restricted along the approach to the grade crossing; however, all of the crossings had limited visibility on at least one of the two approaches.

- Over 90 percent of the drivers felt that auto-train collisions were the result of driver carelessness, yet they continued to exhibit careless behavior.

The results of this survey clearly show that additional driver awareness programs and devices should be developed. Trains are not able to stop or take evasive actions; motorists can.

PHYSICAL CONDITION

Rough grade crossings do cause drivers to slow down. Ironically, if the grade crossing surface is improved, drivers may proceed through the crossing more quickly, and at unguarded crossings may not check for a train's approach.

A study by James Powell, of Alfred Benesch & Co., presented at the 1982 Annual Meeting of the Transportation Research Board (TRB), examined non-accident costs incurred, including fuel, oil, tire wear, vehicle maintenance and depreciation, value of time, and pollutant emissions. These costs were identified for both "occurrence" (train present) and "non-occurrence" (no train) situations. The results showed that the total highway user cost per day ranged from $100 to $300 per crossing. The cost figures include fuel, oil, tire wear, vehicle maintenance, and vehicle depreciation. Non-occurrence costs exceeded occurrence costs by 2.3 to 1. If the crossings were not rough and slowing were required only when a train is present, non-occurrence and occurrence costs would have been about the same.

The high cost associated with non-occurrence indicates that the replacement of rough-surfaced grade crossings with smooth surfaces is cost effective.

INSTITUTIONAL CONCERNS

Many cities find themselves in the position of being unable to make improvements because of a seeming lack of cooperation from the railroad. Especially in the case of a large railroad and a small town, the town may find itself helpless to influence the railroad to make improvements or to work with the community in other areas. Horror stories often are cited by towns that effectively are cut in half for hours daily. As the number of unit trains and long coal trains increases, this problem threatens to become more severe.

Federal government actions sometimes complicate matters further from the local perspective. The Staggers Act permits railroads to speed up abandonment of

routes, shortcutting some of the impact studies which might otherwise have been required.

Abandonment of one route may divert a significant amount of traffic onto other routes, which can in turn cause severe problems. Cities concerned about hazardous materials being transported through their neighborhoods find that a question arises over who has authority to limit such movement, the States or the ICC?

Railroads, as private rather than public entities, are not required to furnish details of planned changes in their operations to city and county officials who may be adversely affected by the changes. Relocation of a side yard, abandonment of a route, scheduling changes, all can have significant adverse effects on the area residents. The City of Toledo, Ohio recently discovered, with 10 days notice, that a portion of the track which encircles the City was being considered for abandonment. If implemented, this would mean that trains now travelling part way around the City and continuing onward would need to travel most of the way around it. Many of the trains involved are coal or grain unit trains, and the result would be a significant increase in blockage of intersections. Considerable last minute effort was required for the City to have the decision delayed, in order that it could have its viewpoint aired.

Beyond the Federal, State, and railroad interjurisdictional questions, there are variations in responsibility at the local level. State law may hold the railroad, State highway department, or a public utility responsible for repairs. This differs from State to State, complicating any attempt at uniformity, and likely causing headaches for the railroads.

Lack of communication can generally be blamed for much of the difficulty which cities and railroads experience when trying to work out their problems. Some jurisdictions contacted for this Information Bulletin reported excellent working relationships with their railroads, others reported adversary relationships. The need exists for an independent liaison office or railroad coordinator which could help smooth the way to better understanding and cooperation between all parties concerned.

Chapter 2

CONTACTS AND CURRENT PROGRAMS

SAFETY

Improvement Prioritization

Many different hazard indices have been developed in the effort to identify which of the thousands of grade crossings should receive priority treatment.

A number of short indices are listed in the Automotive Safety Foundation's "Railroad Grade Crossings." A more recent study, "Development and Application of a Railroad-Highway Accident-Prediction Model," considers up to 39 independent variables in arriving at a formula which can be applied to each crossing. These equations can be used to select grade crossing improvement sites, or identify areas where speed limits (vehicle or train) should be altered.

The FHWA will soon be publishing a further study on the subject, "Rail-Highway Crossing Resource Allocation Procedure User's Guide," document IP-827.

Through the use of these models, it is possible to predict with a high degree of accuracy how much each type of improvement will decrease the accident rate.

Contact:

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Office of Technology and Planning Assistance (HRS-30)
Federal Highway Administration
U.S. Department of Transportation
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FRA and FHWA have conducted a study to develop national standards for crossing improvements and traffic control devices. This concept is opposed by some local officials, who fear the consequences for liability if an accident occurs at a crossing which has not been improved to the prescribed standard, as well as the financial burden which compliance with the standards might impose on the local government.

Evaluation of Warning Devices

Quite a bit of research has been conducted by FHWA, FRA, TSC and others to evaluate the effectiveness of existing and new passive and active warning devices, as well as advance warning devices. Among the studies:

- Stop signs at grade crossings were evaluated and found to be effective when properly located. Results of the study are available in a report entitled Safety Features of Stop Signs at Rail-Highway Grade Crossings,

from the National Technical Information Service (NTIS). (Executive Summary/FHWA-RD-78-40, PB 295 422/AS; Technical Report/FHWA-RD-78-41, PB 295 423/AS.)

- Constant Warning Time devices were studied by Systems Technology Laboratory, Inc. for FHWA and FRA. Drawbacks with the existing devices such as high costs and high power requirements were identified. A copy of the report entitled Constant Warning Time Concept Development for Motorist Warning at Grade Crossings/FRA-ORD-81-07, can be obtained from NTIS, (PB81 205 684).

- Effectiveness values for grade crossing warning devices were updated by TSC in 1981. The findings are similar to values arrived at by the California Public Utilities Commission. The Effectiveness of Flashing Lights and Flashing Lights with Gates in Reducing Accident Frequency at Public Rail-Highway Crossings 1975-1978/FRA-RRS-80-005 is also available from NTIS, PB81 133 886.

A more complete listing of recent studies is contained in the Federally Coordinated Program annual progress report for project 10, Railroad Highway Grade Crossings, available from FHWA.

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Studies underway under the auspices of FHWA include research into improving the use of strobe lights to replace flashing lights. The use of strobe lights is one concept being studied to lessen the problem of alignment, which has been a cause of concern with existing flashing lights. Because of vibrations from rail traffic, regular flashing lights may require frequent realignment.

A thorough study of grade crossing methodology has been compiled by the Texas Transportation Institute for FHWA, entitled Railroad-Highway Grade Crossing Handbook, (FHWA-TS-78-214), and is available from FHWA.

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Driver Behavior

An accident causation study was conducted for the FHWA by Input Output Computer Services, Inc. Recognition errors were found to be the main cause of accidents at crossings with crossbucks (passive warnings). Decision errors were found to be the major cause of accidents at crossings with flashing lights (active warnings). Vol.1, Executive Summary, RD-81/082 and Vol.2, Technical

Report, FHWA/RD-81/083 will be available through NTIS in late 1982. The PB numbers are not yet available.

The National Safety Council, in cooperation with several other agencies and the railroads, has developed a grade crossing safety program entitled Operation Lifesaver, which is intended to educate the public as to the hazards of grade crossings. The program is operated on a statewide basis, often in cooperation with the local police, and includes educational programs at the schools and in the media.

Contact:
The National Safety Council
444 N. Michigan Avenue
Chicago, Illinois 60611
(312) 527-4800

PHYSICAL CONDITION

Reconstruction may be required when the physical condition of the crossing surface deteriorates significantly. There are a number of different materials and construction methods available for rebuilding the crossing surface. A comprehensive description of many of these can be found in Railroad-Highway Grade Crossing Surfaces, Implementation Package 79-8, available from the FHWA.

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New Repair Methods: The Rhode Island Department of Transportation has developed a process for tripling the useful life of a grade crossing. Two and a half-inch thick rubber pads are placed between the rails; a new method of preparing the track's base that cuts down frost heaves is used, the tracks are welded together to produce a continuous rail, and the crossing area is resurfaced. Average cost per crossing is $78,000.

Contact:
Stan Chorney
Department of Transportation, Room 237
State Office Building
Providence, Rhode Island 02093
(401) 277-2086

INSTITUTIONAL RELATIONS

Greensboro, North Carolina, has for the past several years had a good working relationship with the Southern Railway Company on improvement of railroad crossings. This relationship was achieved through the efforts of Greensboro's Department of Public Works in its contacts with railroad officials. All improvements involving the riding surface of the crossings were joint efforts (City paying for materials, and railroad furnishing manpower and doing the

installation). To date, 26 crossings have been improved although no official agreement has ever been signed.

Contact:

John V. Fox, Jr.
Director of Public Works
Drawer W-2
Greensboro, North Carolina
(919) 373-2074

The Association of American Railroads (AAR) has 49 State representatives who can assist local communities in their efforts to work out problems with the railroads. Emphasizing the belief that most problems can be handled if communication channels are opened, the AAR reps try to help community officials get in contact with the appropriate railroad official.

Contact:

Charles Amos
Executive Director
Association of American Railroads
1920 L Street, N.W.
Washington, D.C. 20036
(202) 835-9249

For a list of State representatives, see Table 1.

An extensive study was recently performed for the U.S. Department of Transportation and the North Dakota State Highway Department on Alternative Solutions to Railroad Impacts on Communities, (DOT-I-81-37). A corridor-wide survey of conflicts in rural areas was conducted, the problem causes identified, and low cost solutions were implemented in many cases. Substantial improvements were reported in the areas of general and emergency vehicular delays and in accident prevention. An average project cost $130,000.

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Table 1

AAR STATE REPRESENTATIVES HIGHWAY-RAILROAD PROGRAMS

ALABAMA
Mr. F.J. Kull, Administrator
Grade Crossing Programs
Southern Railway System
99 Spring Street
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(404) 688-0800 X2713

ARIZONA
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Chapter 3

ANNOTATED BIBLIOGRAPHY

This bibliography was compiled by the staff of Public Technology, Inc. and endeavors to give a sampling of literature that will be of particular interest to local officials rather than an exhaustive list of all sources of information on the topic.

Berg, William D., et al. "Causal Factors in Railroad-Highway Grade Crossing Accidents." Paper presented to the 61st Annual Meeting of the Transportation Research Board, January 19, 1982.

This study analyzed the causes of accidents at railroad-highway grade crossings with flashing light or crossbuck warning devices. The major cause of accidents at crossings with flashing lights was found to be a lack of credibility, due to excessive warning time. The major cause of accidents at crossings with crossbucks was driver failure to recognize an approaching or passing train. Potential solutions were identified, including ensuring constant advance warning times for flashing lights, and the installation of advance warning devices at intersections with crossbucks.

Ernst and Whinney. Alternative Solutions to Railroad Impacts on Communities, DOT-I-81-39. Prepared for Minnesota Department of Transportation, the North Dakota State Highway Department and the U.S. Department of Transportation, October 1981.

This report is published in three volumes; a Summary Report, Phase I (Problem Identification), and Phase II (Case Studies). It presents the results of a comprehensive study of the rail corridor along a Burlington Northern, Inc. main line in Minnesota and North Dakota. Based on interviews with local and railroad officials, and the results of questionnaires distributed to residents, the problems of 47 communities along the corridor were identified. These problems were analyzed and low-cost solutions were implemented as demonstration projects. The projects were later evaluated, and found to be very effective in most instances.

Hedley, William J. Railroad-Highway Grade Crossing Surfaces. Implementation Package 79-8, Federal Highway Administration, U.S. Department of Transportation. August 1979.

This report is a thorough examination of the types of railroad-highway grade crossing surfaces available for installation at new or improved crossings. Each type of surface is described in detail, and cross-sectional diagrams are included. Advantages and disadvantages to the surfaces are mentioned, as well as a range of prices. Guidelines for choosing the proper surface are included.

Lavette, Robert A. "Development and Application of a Railroad-Highway Accident-Prediction Equation," Transportation Research Record 628, Transportation Research Board, Washington, D.C.: 1977.

This paper discusses the development of an accident-prediction equation which can be used for prioritizing grade-crossing improvements. It was developed through the use of a step-wise regressional analysis in conjunction with three other statistical techniques. Data from 1140 grade crossings in Florida were analyzed. Up to 39 independent variables were considered and two equations arrived at; one for crossings with active warning devices and one for crossings with passive devices. Crossings were assigned a safety index number derived from the accident prediction model, and improvements in Florida were prioritized by this rating.

Mayer, Peter A., gen. ed. Traffic Control and Roadway Elements. 14 chapters. Automotive Safety Foundation, 1968. Chapter 1: Railroad Grade Crossings, by Hoy A. Richards and G. Sadler Bridges, Texas Transportation Institute.

This is the first revision of a document published in 1963. It contains a number of different mathematical formulae which may be helpful when considering grade crossing improvements. Eleven hazard index formulae are presented. These may be used when prioritizing improvements. The relative hazard relationships between protective devices are listed, which gives an indication of the gain from installing a particular device. There is also a discussion of the required sight distances for a driver to make the proper decision when approaching a crossing.

This publication is currently undergoing a second revision, which should be completed in late 1983.

Powell, James L. "Effects of Rail-Highway Grade Crossings on Highway Users," Paper presented to the 61st Annual Meeting of the Transportation Research Board, January 19, 1982.

This paper examines the effects of railroad grade crossings on highway users. Factors considered are delay, user costs (vehicle maintenance, fuel, oil, depreciation), energy consumption, and pollutant emissions. The study separates accident costs from non-accident costs, and the cost of slowing or stopping when a train is present from when a train is not present. Computer simulation and analytic models were applied to analyze delays and estimate the effects on users.

The conclusion reached is that the non-accident costs of grade crossings exceed the accident costs by about 3.5 to 1. Within the non-accident cost category, the no-train costs exceed the train costs by about 2 to 1. In enabling cities to identify and quantify these costs, the methods facilitate cost-benefit analysis of grade crossing improvements.

Sanders, James. "Driver Performance in Countermeasure Development at Railroad-Highway Grade Crossings," Transportation Research Record 562, Transportation Research Board, Washington, D.C: 1976.

This report summarizes the results of a field study which evaluated driver behavior and attitudes at grade crossings. At nine selected grade crossings, driver behavior was observed. The drivers were then asked to complete a questionnaire regarding the crossing itself and railroad-highway grade crossings in general. The results showed that drivers overestimate the degree of protection at a crossing site, underestimate their speed, and slow down for crossings because of their roughness rather than for safety reasons. The results should be useful to those installing warning

equipment, who must anticipate drive behavior. This summary briefly mentions a plan for developing countermeasures to prevent accidents. For more detailed information, one may wish to read the initial report, entitled *Human Factors Countermeasures to Improve Highway-Railway Intersection Safety*, by J.H. Sanders, G.S. Kolsrud, and W.G. Berger, for Biotechnology, Inc., in June 1973.

Texas Transportation Institute, *Railroad-Highway Grade Crossing Handbook*. Prepared for the Federal Highway Administration, August 1978.

This is a very thorough, detailed book covering all aspects of grade crossings. It does not attempt to review the latest research and technological developments, but provides a comprehensive guide to understanding the requirements of the crossings, and the elements of the system. It offers guidelines to assist in improving grade crossings and can serve as a text for training programs.

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